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## CERTIFICATE

This certificate is issued in support of an application for Patent registration in a country outside New Zealand pursuant to the Patents Act 1953 and the Regulations thereunder.

I hereby certify that annexed is a true copy of the Provisional Specification as filed on 21 January 2004 with an application for Letters Patent number 530720 made by BRYHER HOLDINGS LIMITED.

I further certify that pursuant to a claim under Section 24(1) of the Patents Act 1953, a direction was given that the application proceed in the name of IMPIAN TECHNOLOGIES LIMITED.

Dated 2 August 2004.

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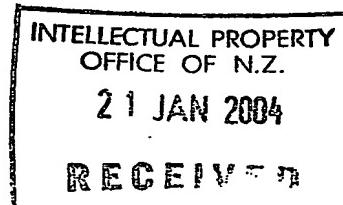
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NEW ZEALAND  
PATENTS ACT, 1953

**PROVISIONAL SPECIFICATION**

**VETERINARY APPARATUS AND METHOD OF USE**

We, BRYHER HOLDINGS LIMITED, a New Zealand company, of Level 1, The Mall,  
236-256 Karori Road, Karori, Wellington, New Zealand, do hereby declare this invention  
to be described in the following statement:



## Field of the Invention

The present invention relates to an apparatus for positioning an item in or near a natural orifice of a non-human animal.

## Background of the Invention

The delivery or collection of substances to or from living non-human animals has commonly involved injections or devices requiring surgical implantation or retention within a natural body cavity, for example the rumen or the vagina. The administration of substances by injection often causes abscesses and high levels of the substances are frequently found at the injection site at slaughter. Injections also can damage the hide and are therefore restricted to particular sites, e.g. to the neck region. Many drugs do not achieve their maximum therapeutic action through conventional injection techniques. The therapeutic action of such drugs is improved considerably when delivered at a controlled rate to maintain optimum drug concentration for a specific period. In a typical drug injection, a greater drug concentration than necessary must be administered to keep the drug concentration within the effective therapeutic margin for the minimum period necessary for treatment. With controlled drug infusion, the drug can be given at a precise rate that will keep the drug serum concentration above a therapeutic minimum and below toxic levels. Many drugs reach their full potential effectiveness only through precise delivery over extended periods of time.

In animal husbandry the administration of drugs to animals involves a great deal of handling which is laborious for the handler and stressful for the animals. Often animals must be brought in from long distances making prolonged or frequent treatment difficult if not prohibitive. In some cases the stress levels caused by handling stock can impair the performance of the treatment, this is particularly true in deer. Many drugs are given in slow release capsules that can cause problems when still remaining in the animal at slaughter.

Devices for implantation or insertion require a means for releasing the substance into the body. This may be controlled diffusion or by the action of a pump. Some devices

incorporating pumps use a battery as a power source linked to the pump via simple electronic circuitry. Difficulties arise when internally located devices, such as surgically implanted or intra-ruminal devices, remain in animals at slaughter.

There are many disadvantages in techniques requiring surgical implantation of substance delivery devices. The device requires surgical intervention for implantation and for removal of the device. There is limited control over dose timing and dose rate. There is no interruption of the dose or variation of the dose substance without surgical intervention. There is no indication of satisfactory operation of the device and no monitoring of physiological or other animal parameters. Substances cannot be collected from the animal. There is a wide variation in the uncontrolled rate of delivery of the substance, and the volume of material that can be delivered is limited by the size of the surgical implant.

Many drug treatments on farms require the sequential and accurately timed delivery of more than one substance to achieve the desired result. This is particularly true of hard to breed stock that require treatment with up to three hormones in a precisely timed delivery programme to effect oestrus. These types of treatment require frequent visits by the veterinarian and are therefore normally reserved for valuable stock.

Some cattle problems such as facial eczema are treated with daily drenches of minerals in low amounts. This is difficult enough with dairy or milking stock but is a particular problem for dry stock, which must be yarded each day.

WO 96/00106 discloses an implantable drug delivery pump system including a sensor, a pump controller, pumps and delivery systems, all preferably implanted within a body. The pumps deliver a controlled volume or a controlled rate of two or more substances, e.g. an agent and counter-agent, to the body, in response to a body condition sensed by the sensor, e.g. temperature, pressure or the presence of glucose or other constituents. The pumps are preferably electrically controlled and may be any conventionally known pump, e.g. piston, peristaltic or centrifugal.

WO 94/01165 discloses a medication-administering device in the form of a 'smart' capsule for introduction into a body cavity. The capsule is said to be particularly suited to being

taken orally, but may form a suppository for taking other than orally, or may be surgically introduced to a body. The capsule casing is insoluble in body cavity fluids and contains a reservoir containing the medication which is expelled into the body cavity by a pump driven by an electrolytically-generated gas. A microprocessor controls the rate of delivery of the medication which may be varied in response to body conditions, eg pH, temperature, sound or moisture, monitored by sensors included in the capsule. An electrolytic cell co-operates with body fluids surrounding the capsule to generate electrical power to supply the microprocessor and the gas generator. The capsule may also include a radio transceiver enabling the location of the capsule to be monitored, or the operation of the capsule to be controlled, from outside the body.

The insertion of a device completely within a body cavity imposes several limitations and difficulties. The size of a device is limited by the size of the body cavity of the animal within which it is to be inserted. The dimensions of any retaining means are also limited by the size of the body cavity. The size of any batteries required, and therefore the length of time over which the device may be expected to operate, is also limited. The quantity of substance that can be delivered or collected is also limited by the dimensions of the cavity into which the device is to be inserted.

Other problems of inserted devices relate to materials which are incompatible or at least undesirable for use within an animal body: e.g. lithium batteries.

Such substance delivery devices also require a means for retaining the device within the cavity of the animal. Without a reliable retention means, the device may be expelled by the animal or may simply fall out.

A device inserted into body cavities may be subject to natural muscular actions, e.g. peristalsis, tending to expel the device. This can cause problems with retention of devices. It is therefore desirable that systems provide confirmation that they remain inserted and correctly located. Known methods of retaining devices in body cavities include compressible helical coils, flexible lobes or arms which can splay outwardly from the device once the device is inserted within the body cavity, and distensible ribs which can be

distended by plunger action once the device has been inserted. When extended, the projections engage the cavity walls to assist in retention of the device.

WO 96/29025 discloses an apparatus for retaining a substance delivery device in a body cavity, eg intravaginal and intraruminal devices for domestic animals such as cows. The apparatus has multiple flexible arms which splay outwardly after insertion into a body cavity to retain the apparatus therein. The arms are said to bend without breaking in response to peristaltic waves within the cavity and to return to their fully extended position once peristaltic waves have passed. The delivery device is said in one embodiment to include a battery which powers piezo pumps, preferably three, for delivering substances contained in reservoirs, under control of a microprocessor. A possible application, in which the apparatus dispenses different doses of different hormones over predetermined times to positively define the date of oestrus, is disclosed. Also disclosed is the possibility that the microprocessor makes a determination of one or more physiological parameters monitored by one or more sensors, e.g. temperature, acidity, viscosity and odour, before controlling the timing or the amount of a delivery of a substance to the body.

NZ 207341 is a further example disclosing a device not requiring surgical insertion into a body cavity of an animal and which produces a controlled rate of release into the body, of leachable chemicals incorporated into the device. NZ 207341 discloses a device having a spine with two resiliently hinged legs biased into a splayed disposition in which the device is T-shaped. With the legs folded together, the device may be inserted into the body cavity. A coating on the spine incorporates a chemical which leaches out when exposed to body fluids.

In devices employing outwardly-extending finger-like projections to engage the walls of a body cavity, the projections can interfere with the flow of normal body secretions. Where a device is implanted in a vaginal cavity, the projections can impair the flow of vaginal mucous. The fingers operate by pressing outwardly on the vaginal walls, holding them apart. This impairs the normal peristaltic action, retarding the normal mucous flow, and provides a void which allows an undesirable build-up of mucous around the device. The

build-up of mucous often becomes infected and can interfere with the release of therapeutic material from the device and its uptake by the body.

In WO93/02634 there is described a device for artificial insemination of sows. The device is made up of a frame consisting of two hoops and a spinal column fitted over the back of a sow with a holder for a sperm tube. There is a small extension of the sperm tube extending into the vagina. The extension does not have a locator which is retained in a predetermined position within the vagina and it is possible that in the process of insemination seminal fluid in the sperm tube may well be lost or not delivered within the vagina.

In US 2002/0017250 there is described an artificial insemination device for sows. The device includes a saddle which is placed on the back of an animal and a clip which can grip the flanks of the animal. A rigid arm extends upwardly and rearwardly from the saddle, and supports a sachet containing semen, and a probe extends into the vagina of the animal. A constant pressure applicator associated with the sachet maintains the animal semen in the sachet under pressure. It can be seen that this device holds the sachet at an elevated position, meaning that it would not be suitable for long term use on freely ambulatory field animals, as they could easily damage the sachet or device as it projects a significant distance above the body of the animal. Further, there is no provision for maintaining the probe in the animal's vagina, and it could easily be expelled with movement of the animal.

WO99/43269 describes a veterinary device for transporting fluid between a reservoir and a natural body cavity, such as an animal's vagina. The device includes a reservoir in fluid communication with a locator which passes through a natural orifice of the animal, and a securing means to secure the apparatus to the animal. The securing means includes a first strap which extends transversely around the body of the animal and a second strap which extends longitudinally rearwardly along the back of the animal and which encircles the animal's tail. A pair of elasticised tie lines assist in maintaining the locator within the orifice. However, it has been found with such tie lines that as the animal flexes its back or moves, upward pressure may be applied to the locator, which can result in chaffing in the orifice. Also described in that document is the use of adhesive pads to attach tie lines to

the sides of the animal in the vicinity of the orifice. These adhesive pads are easily removed by the animal rubbing the area.

It is an object of preferred embodiments of the present invention to provide an apparatus for positioning an item in or near a natural orifice of a non-human animal which addresses some of the disadvantages outlined above, and/or which at least provides the public with a useful choice.

### **Summary of the Invention**

In a first aspect, the invention broadly consists in a positioning apparatus for positioning an item in or near a natural orifice of a non-human animal, including: at least one resilient rod adapted to the shape of part of the animal's body above the orifice and to overhang that part of the animal's body; and a transverse cross member mounted on the rod(s) in the overhanging region of the rod(s), which cross member is adapted in use to be biased into contact with the animal's body in the region of the natural orifice as a result of the resilience of the rod(s).

In a preferred embodiment the rod(s) has/have sufficient flexibility and stiffness that it/they can be manually adapted to the shape of said part of the body of the animal, but will then maintain that shape in the absence of further manual shaping.

In a preferred embodiment, the apparatus comprises two said rods, with the cross member mounted between the two said rods. The transverse cross member is preferably rigidly mounted to the rod(s), so as to not move relative to the rod(s). Alternatively, the transverse member may be mounted to the rod(s) with sufficient friction that it can be manually moved to a desired position on the rod(s), but will maintain that position in the absence of further manual adjustment.

The natural orifice may be a vagina, anus, mouth, or nostril of the animal for example.

In one embodiment, the cross member may include or be attached to a sensor to sense a body condition or occurrence. Such a configuration is particularly useful when the

apparatus is adapted such that the cross member is in the vicinity of an animal's vagina, to determine when the animal is urinating.

The cross member may include an arrangement to dispense a substance, more preferably in response to sensing of a body condition or occurrence. In a particularly preferred embodiment, the arrangement is adapted to dispense nitrogen compounds or other substances into a urine stream. The arrangement may comprise a receptacle in the cross member, or may comprise a tube which is in fluid connection with a separate reservoir.

The arrangement may include a sensor to determine whether an animal is urinating, which may operate a pump or open a valve to dispense the substance. Alternatively, the cross member may include an aperture which forms a venturi mixer, so that the animal's urine sucks the substance out of the tube and mixes it with the urine.

In a particularly preferred embodiment, the cross member includes or is attached to a sensor to measure one or more urine properties selected from the group of conductivity, Brix (sugar levels), colour, transparency, light transmission at different frequencies, temperature, pH, or osmolarity. The apparatus is preferably configured to introduce one or more substances into or onto the animal's body in response to the measurement. An electrical and/or data connection may be provided between the cross member and a data device to transmit data from the sensor. The data device may be provided in a saddle which sits on the back of the animal, and the data device may send signals in response to the received measurements to introduce the substance(s) into or onto the animal's body.

The cross member may include an arrangement to collect a substance, such as a sample of the animal's urine, which may comprise a receptacle in or carried by the cross member.

The transverse cross member may include a holding portion which is connectable to an item for insertion into the animal's natural orifice, and may act as a penetration control means to resist over-penetration of the item into the orifice. In this embodiment, the cross member is slidably mounted to the rod(s) to enable the cross member and thereby an item connected thereto to move vertically relative to the rod(s) when the animal moves. In a preferred embodiment, the cross member is attached to the rod(s) by means of clip

portion(s) which, in the embodiment having two rods, may be located at each end of the cross member. The cross member is preferably removable from the rod(s). The or each rod preferably includes a stopper at a lower end thereof to prevent the cross member from sliding off the lower end(s) of the rod(s).

The transverse cross member may form an integral part of a device for part penetration into a natural orifice of the animal, which includes the cross member and a shaft portion which is unitary with the cross member. In this embodiment, the cross member is slidably mounted to the rod(s) to enable the cross member and thereby the shaft portion to move vertically relative to the rod(s) when the animal moves. The cross member preferably acts as a penetration control means to resist over-penetration of the shaft portion into the orifice. In a preferred embodiment, the cross member is attached to the rod(s) by means of clip portion(s) which, in the embodiment having two rods, may be located at an or each end of the cross member. The cross member is preferably removable from the rod(s). The or each rod preferably includes a stopper at a lower end thereof to prevent the cross member from sliding off the end(s) of the rod(s).

The cross member preferably extends in two mutually opposite directions transverse to said shaft portion, to form a substantially T-shaped device. Alternatively, the cross member may extend substantially in a single direction transverse to said shaft portion, to form a substantially L-shaped device.

The shaft portion may be configured to deliver a substance into the orifice of the animal. Alternatively, the shaft portion may be configured to extract a substance from the orifice of the animal. In one embodiment, this can be achieved when the apparatus incorporates a pump, which pump can be operated in a delivery or extraction mode by reversing the pump. A preferred pump is of the type described in co-pending New Zealand Patent Application No. 523300.

The rod(s) may be maintained on the animal's body by a harness arrangement which for example engages the back and sides of the animal. In the embodiment arranged for penetration or use near a posterior orifice of the animal, the rod(s) may be attachable to or may be provided as part of a saddle-type arrangement which sits on the animal's back or

rump with the rods extending rearwardly therefrom. The saddle may be of the type described in WO99/43269 for example, and may comprise one or more reservoirs for receipt of a substance to be delivered to the animal via the apparatus.

In a particularly preferred embodiment having two rods, the rods are spaced from one another with sufficient spacing that the animal's tail can extend therebetween. It will be appreciated that a muzzle-type arrangement could be used to maintain the rod(s) on the snout of an animal if the device is to be used with the nose or mouth of the animal.

The shaft portion may include one or more apertures for delivery of a substance into a cavity associated with the orifice of the animal. In a preferred embodiment, a channel is provided in the shaft portion and cross member, for receipt of fluid delivery tubing. One or more apertures may be provided in the shaft portion to dispense fluid at different locations. In a particularly preferred embodiment, three apertures are provided at different locations along the shaft portion, and the channel is configured for receipt of three tubes which may be fluidly connected to different reservoirs, such that three different substances can be delivered into the cavity. The reservoirs are preferably provided in the saddle.

The shaft portion may be configured to sense an internal body condition or occurrence, and may include or be attached to a sensor for this purpose. An electrical and/or data connection may be provided between the shaft portion and a data device to transmit data thereto. The data device may be provided in the saddle.

As an alternative, a power supply and/or data device may be attached to, or included within, the shaft portion or cross member.

Rather than comprising channels, the shaft portion and/or cross member may be tubular for delivery of fluid and/or receipt of electrical and/or data cable.

The rods are preferably sufficiently resilient to bias the shaft portion into the animal's orifice.

The width of the cross member is advantageously greater than the size of the animal's orifice, so that the cross member restrains over-penetration of the item into the animal's orifice.

It will be appreciated that the rods need not be substantially circular in cross section, although that is the preferred embodiment. Rather, the rods could be substantially flat members, could be elliptical or could be other polygonal cross-sectional shapes for example.

In a second aspect, the invention broadly consists in an apparatus for positioning an item near a posterior natural orifice of a non-human animal, including: a pair of resilient rods adapted to the shape of the animal's rump and to overhang the animal's rump; and a cross member connected to and extending between the rods in the overhanging region, the cross member including or attached to a sensor for sensing when an animal is urinating or to measure a urine property, the resiliency of the rods being such that in use the cross member and thereby the sensor is positioned adjacent the animal's body in the region of a posterior orifice.

In a preferred embodiment the rods have sufficient flexibility and stiffness that they can be manually adapted to the shape of said rump of the animal, but will then maintain that shape in the absence of further manual shaping.

The transverse cross member is preferably rigidly mounted to the rod(s), so as to not move relative to the rod(s). Alternatively, the transverse member may be mounted to the rod(s) with sufficient friction that it can be manually moved to a desired position on the rod(s), but will maintain that position in the absence of further manual adjustment.

The cross member may also include an arrangement to dispense a substance, more preferably in response to sensing of a body condition or occurrence. In a particularly preferred embodiment, the arrangement is adapted to dispense nitrogen compounds or other substances into a urine stream. The arrangement may comprise a receptacle in the cross member, or may comprise a tube which is in fluid connection with a separate reservoir.

The arrangement may include a sensor to determine whether an animal is urinating, which may operate a pump or open a valve to dispense the substance. Alternatively, the cross member may include an aperture which forms a venturi mixer, so that the animal's urine sucks the substance out of the tube and mixes it with the urine.

In a particularly preferred embodiment, the cross member includes or is attached to a sensor to measure one or more urine properties selected from the group of conductivity, Brix (sugar levels), colour, transparency, light transmission at different frequencies, temperature, pH, or osmolarity. The apparatus is preferably configured to introduce one or more substances into or onto the animal's body in response to the measurement. An electrical and/or data connection may be provided between the cross member and a data device to transmit data from the sensor. The data device may be provided in a saddle which sits on the back of the animal, and the data device may send signals in response to the received measurements to introduce the substance(s) into or onto the animal's body.

The cross member may include an arrangement to collect a substance, such as a sample of the animal's urine, which may comprise a receptacle in or carried by the cross member.

The rods may be maintained on the animal's body by a harness arrangement which for example engages the back and sides of the animal. The rods may be attachable to or may be provided as part of a saddle-type arrangement which sits on the animal's back or rump with the rods extending rearwardly therefrom. The saddle may be of the type described in WO99/43269 for example, and may comprise one or more reservoirs for receipt of a substance to be delivered through the dispenser.

The rods are preferably spaced from one another with sufficient spacing that the animal's tail can extend therebetween.

It will be appreciated that the rods need not be substantially circular in cross section, although that is the preferred embodiment. Rather, the rods could be substantially flat members, could be elliptical, or could be other polygonal cross-sectional shapes for example.

In a third aspect, the invention broadly consists in an apparatus for positioning an item in a posterior natural orifice of a non-human animal, including: a pair of resilient rods adapted to the shape of the animal's rump and to overhang the animal's rump; and a cross member slidably connected to and extending between the rods in the overhanging region, the cross member being arranged for connection to an item to be inserted into a posterior orifice of the animal, and enabling vertical movement of the cross member relative to the rods in response to movement of the animal.

In a preferred embodiment the rods have sufficient flexibility and stiffness that they can be manually adapted to the rump of the animal, but will then maintain that shape in the absence of further manual shaping.

In one embodiment, the cross member may include or be attached to a sensor to sense a body condition or occurrence. Such a configuration is particularly useful when the apparatus is adapted such that the cross member is in the vicinity of an animal's vagina, to determine when the animal is urinating.

The cross member may include an arrangement to dispense a substance, more preferably in response to sensing of a body condition or occurrence. In a particularly preferred embodiment, the arrangement is adapted to dispense nitrogen compounds or other compounds into a urine stream. The arrangement may comprise a receptacle in the cross member, or may comprise a tube which is in fluid connection with a separate reservoir.

The arrangement may include a sensor to determine whether an animal is urinating, which may operate a pump or open a valve to dispense the substance. Alternatively, the cross member may include an aperture which forms a venturi mixer, so that the animal's urine sucks the substance out of the tube and mixes it with the urine.

In a particularly preferred embodiment, the cross member includes or is attached to a sensor to measure one or more urine properties selected from the group of conductivity, Brix (sugar levels), colour, transparency, light transmission at different frequencies, temperature, pH, or osmolarity. The apparatus is preferably configured to introduce one or more substances into or onto the animal's body in response to the measurement. An

electrical and/or data connection may be provided between the cross member and a data device to transmit data from the sensor. The data device may be provided in a saddle which sits on the back of the animal, and the data device may send signals in response to the received measurements to introduce the substance(s) into or onto the animal's body.

The cross member may include an arrangement to collect a substance, such as a sample of the animal's urine, which may comprise a receptacle in or carried by the cross member.

In a preferred embodiment, the cross member is attached to the rods by means of clip portions which may be located at each end of the cross member. The cross member is preferably removable from the rods. The or each rod preferably includes a stopper at a lower end thereof to prevent the cross member from sliding off the lower ends of the rods.

The item may be removable from connection with the cross member and interchangeable with another item. For example, the item may comprise a thermometer for insertion into the orifice, or may include a shaft portion for insertion into the orifice.

The cross member preferably extends in two mutually opposite directions transverse to said shaft portion when connected, to form a substantially T-shaped device.

The shaft portion may be configured to deliver a substance into the orifice of the animal. Alternatively, the shaft portion may be configured to extract a substance from the orifice of the animal. In one embodiment, this can be achieved when the apparatus incorporates a pump, which pump can be operated in a delivery or extraction mode by reversing the pump. A preferred pump is of the type described in co-pending New Zealand Patent Application No. 523300.

The rods may be maintained on the animal's body by a harness arrangement which for example engages the back and sides of the animal. In the embodiment arranged for penetration or use near a posterior orifice of the animal, the rods may be attachable to or may be provided as part of a saddle-type arrangement which sits on the animal's back or rump with the rods extending rearwardly therefrom. The saddle may be of the type

described in WO99/43269 for example, and may comprise one or more reservoirs for receipt of a substance to be delivered to the animal via the apparatus.

The rods are preferably spaced from one another with sufficient spacing that the animal's tail can extend therebetween.

The shaft portion may include one or more apertures for delivery of a substance into a cavity associated with the orifice of the animal. In a preferred embodiment, a channel is provided in the shaft portion and cross member, for receipt of fluid delivery tubing. One or more apertures may be provided in the shaft portion to dispense fluid at different locations. In a particularly preferred embodiment, three apertures are provided at different locations along the shaft portion, and the channel is configured for receipt of three tubes which may be fluidly connected to different reservoirs, such that three different substances can be delivered into the cavity. The reservoirs are preferably provided in the saddle.

The shaft portion may be configured to sense an internal body condition or occurrence, and may include or be attached to a sensor for this purpose. An electrical and/or data connection may be provided between the shaft portion and a data device to transmit data thereto. The data device may be provided in the saddle.

As an alternative, a power supply and/or data device may be attached to, or included within, the shaft portion or cross member.

Rather than comprising channels, the shaft portion and/or cross member may be tubular for delivery of fluid and/or receipt of electrical and/or data cable.

The rods are preferably sufficiently resilient to bias the shaft portion into the animal's orifice.

The width of the cross member is advantageously greater than the size of the animal's orifice, so that the cross member restrains over-penetration of the item into the animal's orifice.

It will be appreciated that the rods need not be substantially circular in cross section, although that is the preferred embodiment. Rather, the rods could be substantially flat members, could be elliptical, or could be other polygonal cross-sectional shapes for example.

In a fourth aspect, the invention broadly consists in an apparatus for positioning a shaft portion in a posterior natural orifice of a non-human animal, including: a pair of resilient rods adapted to the shape of the animal's rump and to overhang the animal's rump; and a substantially T-shaped member, which includes a transverse cross member which is slidably connected to and extending between the rods in the overhanging region and a shaft portion for insertion into the orifice of the animal, the cross member being vertically moveable relative to the rods in response to movement of the animal.

In a preferred embodiment the rods have sufficient flexibility and stiffness that they can be manually adapted to the shape of said rump of the animal, but will then maintain that shape in the absence of further manual shaping.

In one embodiment, the cross member may include or be attached to a sensor to sense a body condition or occurrence. Such a configuration is particularly useful when the apparatus is adapted such that the cross member is in the vicinity of an animal's vagina, to determine when the animal is urinating.

The cross member may include an arrangement to dispense a substance, more preferably in response to sensing of a body condition or occurrence. In a particularly preferred embodiment, the arrangement is adapted to dispense nitrogen compounds or other substances into a urine stream. The arrangement may comprise a receptacle in the cross member, or may comprise a tube which is in fluid connection with a separate reservoir.

The arrangement may include a sensor to determine whether an animal is urinating, which may operate a pump or open a valve to dispense the substance. Alternatively, the cross member may include an aperture which forms a venturi mixer, so that the animal's urine sucks the substance out of the tube and mixes it with the urine.

In a particularly preferred embodiment, the cross member includes or is attached to a sensor to measure one or more urine properties selected from the group of conductivity, Brix (sugar levels), colour, transparency, light transmission at different frequencies, temperature, pH, or osmolarity. The apparatus is preferably configured to introduce one or more substances into or onto the animal's body in response to the measurement. An electrical and/or data connection may be provided between the cross member and a data device to transmit data from the sensor. The data device may be provided in a saddle which sits on the back of the animal, and the data device may send signals in response to the received measurements to introduce the substance(s) into or onto the animal's body.

The cross member may include an arrangement to collect a substance, such as a sample of the animal's urine, which may comprise a receptacle in or carried by the cross member.

In a preferred embodiment, the cross member is attached to the rods by means of clip portions which, in the embodiment having two rods, may be located at an or each end of the cross member. The cross member is preferably removable from the rods. The or each rod preferably includes a stopper at a lower end thereof to prevent the cross member from sliding off the ends of the rods.

The shaft portion may be configured to deliver a substance into the orifice of the animal. Alternatively, the shaft portion may be configured to extract a substance from the orifice of the animal. In one embodiment, this can be achieved when the apparatus incorporates a pump, which pump can be operated in a delivery or extraction mode by reversing the pump. A preferred pump is of the type described in co-pending New Zealand Patent Application No. 523300.

The rods may be maintained on the animal's body by a harness arrangement which for example engages the back and sides of the animal. The rods may be attachable to or may be provided as part of a saddle-type arrangement which sits on the animal's back or rump with the rods extending rearwardly therefrom. The saddle may be of the type described in

WO99/43269 for example, and may comprise one or more reservoirs for receipt of a substance to be delivered to the animal via the apparatus.

In a particularly preferred embodiment having two rods, the rods are spaced from one another with sufficient spacing that the animal's tail can extend therebetween.

The shaft portion may include one or more apertures for delivery of a substance into a cavity associated with the orifice of the animal. In a preferred embodiment, a channel is provided in the shaft portion and cross member, for receipt of fluid delivery tubing. One or more apertures may be provided in the shaft portion to dispense fluid at different locations. In a particularly preferred embodiment, three apertures are provided at different locations along the shaft portion, and the channel is configured for receipt of three tubes which may be fluidly connected to different reservoirs, such that three different substances can be delivered into the cavity. The reservoirs are preferably provided in the saddle.

The shaft portion may be configured to sense an internal body condition or occurrence, and may include or be attached to a sensor for this purpose. An electrical and/or data connection may be provided between the shaft portion and a data device to transmit data thereto. The data device may be provided in the saddle.

As an alternative, a power supply and/or data device may be attached to, or included within, the shaft portion or cross member.

Rather than comprising channels, the shaft portion and/or cross member may be tubular for delivery of fluid and/or receipt of electrical and/or data cable.

The rods are preferably sufficiently resilient to bias the shaft portion into the animal's orifice.

The width of the cross member is advantageously greater than the size of the animal's orifice, so that the cross member restrains over-penetration of the item into the animal's orifice.

It will be appreciated that the rods need not be substantially circular in cross section, although that is the preferred embodiment. Rather, the rods could be substantially flat members, could be elliptical, or could be other polygonal cross-sectional shapes for example.

This invention may also be said to broadly consist in the parts, elements, and features referred to or indicated in the specification of the application, individually or collectively, and any or all combinations of any two or more said parts, element or features, and where specific integers are mentioned herein which have known equivalents in the art to which this invention relates, such known equivalents are deemed to be incorporated herein as if individually set forth.

The invention consists in the foregoing and also envisages constructions of which the following gives examples only.

#### **Brief Description of the Drawings**

Preferred embodiments of the invention will now be described by way of example only and with reference to the accompanying drawings in which:

Figure 1 is a perspective view of one embodiment of the present invention;

Figure 2 shows the apparatus of Figure 1 positioned on a cow;

Figure 3 shows a schematic plan view of one member for use with the rods of Figures 1 and 2; and

Figure 4 shows a part sectional view through an alternative member for use with the rods of Figures 1 and 2.

#### **Detailed Description of Preferred Forms**

Figure 1 illustrates one preferred form of the present invention which includes a saddle arrangement 1 for placing over an animal's rump.

A pair of resilient rods 2 extend from the rear of the saddle 1 in a substantially parallel arrangement, and are adapted to conform to the shape of the animal's rump as best shown in Figure 2. In use, the rods overhang the rump and extend down to or past the animal's anus or vagina. The saddle 1 acts to anchor the rods 2 to the rear of the animal. If necessary or desirable, the saddle can be strapped to the rump of the animal, to enhance stability.

The rods 2 are preferably sufficiently flexible and stiff that they can be manually adapted to the shape of the rump of an animal, but will then maintain that shape in the absence of further manual shaping.

A substantially T-shaped member indicated generally by reference numeral 3, includes a cross member 4 and a shaft portion 5. The cross member 4 is located between the resilient rods 2 and is slidably attached thereto via clips 6 located at each end of the cross member 4. The clips define apertures 7 to house the rods 2. The cross member 4 is preferably detachable from the rods, and although not shown in the figures stops are preferably provided at the lower ends of the rods to prevent downward movement of the cross member beyond the ends of the rods.

The clips 6 are a preferred means for slidably attaching the cross member 4 to the rods 2, but are not essential. For example, the cross member could function in the same manner with sleeves adapted to receive the rods.

The apertures 7 are preferably of a sufficient size such that there is little friction inhibiting movement of the cross member on the rods. This enables the cross member to self-adjust its vertical position on the rods according to the movement of the animal when the shaft portion is inserted in an animal's orifice.

As will be described below, whilst the shaft portion 5 and cross member 4 are shown as an integral member, they could be provided separately. The shaft portion of this embodiment is adapted to be inserted into a posterior orifice, in particular the vagina, of the animal, as is best indicated in Figure 2. It can be seen in side view that the shaft portion 5 illustrated in Figures 1 and 2 is preferably of a curved shape to adapt to the shape of the vaginal cavity.

This assists in reducing stress to the animal, and improves retention of the shaft portion in the cavity.

The shaft portion 5 and cross member 4 may be tubular, and define hollow cross sections which are in communication with each other to form a continuous internal channel. Alternatively, and in a preferred embodiment, a channel may be provided in the underside of the shaft portion and cross member 4, through which a tube or tubes can extend. A particularly preferred embodiment includes a number of apertures 9 (only one of which is shown in the figures) in the shaft portion for delivery of different substances into different positions within a cavity of the animal. Although not shown in the figures, in one embodiment a sensor is either attached to the shaft portion 5, or may be provided as an integral part thereof, to sense a condition or occurrence within the orifice or cavity. For example, the sensor may be configured to detect temperature within the cavity.

A conduit 8 extends between the saddle arrangement 1 and an opening 9 in the cross member 4. The conduit is configured for receipt of one or more tubes for delivery of a substance or substances to the shaft portion, and more preferably to receive one or more tubes which extend through the conduit 8, into the cross member 4 and to the aperture(s) 9 in the shaft portion 5 for dispensing of the substance(s). In the embodiment including a sensor, a wire may extend from the sensor, through the shaft portion 5, through the cross member 4, and through the conduit 8 to the saddle arrangement. The wire may be connected to a device in the saddle arrangement which records data from the sensor.

In the form illustrated in Figures 1 and 2, the shaft portion 5 is provided integrally with the cross member 4. However, it is also envisaged that the shaft portion may be detachable, and the cross member 4 may be configured to hold the shaft portion or another item. In a preferred embodiment, the shaft portion would be interchangeable with another item such as a thermometer for example. The thermometer could be attached to the cross member to locate the thermometer in a desired position within the orifice. The connection between the cross member and the item may be by way of a screw thread, snap fit, or other arrangement.

In an alternative embodiment, it is not necessary to include a shaft portion or other item which is attachable to or integral with the cross member. Rather, the cross member could be used to locate a sensor against a body part of the animal, and most preferably in the urine stream of the animal. In such an embodiment, the cross member will preferably be rigidly attached to the rod(s), as it will be appreciated that there will be no penetration by the device into an orifice of an animal to maintain the position of the cross member on the rods. Alternatively, the vertical position of the cross member relative to the rods may be manually adjusted to a desired position, but there will be sufficient friction between the rods and the cross member that the cross member will not move from the desired position in the absence of further manual adjustment. The sensor may be part of or may be attached to the cross member, and may be electrically connected to a device in the saddle arrangement as outlined above.

The cross member may include or be attached to a dispenser to dispense a substance into the urine stream of the animal. Two suitable embodiments for dispensing a substance into the urine stream are shown in Figures 3 and 4 and described below. The dispenser may be in the form of a receptacle in or carried by the cross member, or could be a tube which is fluidly connected to the saddle arrangement in the manner outlined above. The dispenser is preferably configured to add nitrogen compounds to the urine stream, to form a fertilizer. The cross member may also include an arrangement to collect a substance, such as a sample of the animal's urine, which may comprise a receptacle in or carried by the cross member.

It will be appreciated that the sensor and/or dispenser in or attached to the cross member could be provided in an embodiment having the shaft portion 5, and which has the cross member slidable relative to the rods.

The cross member preferably includes or is attached to a sensor to measure one or more urine properties selected from the group of conductivity, Brix (sugar levels), colour, transparency, light transmission at different frequencies, temperature, pH, or osmolarity. For example, the sensor could comprise two electrodes to measure conductivity/resistance. The resistance would be infinite until urination occurs, and the resistance could be

measured over time. By measuring one or more of these properties, the metabolic status of the animal can be determined. Such an arrangement could be provided either in the embodiment including a shaft portion or other item for insertion into an orifice, or can be used in the embodiment without the shaft portion.

The apparatus is preferably configured to introduce one or more substances into or onto the animal's body in response to the measurement. The substance(s) may be introduced into a cavity of the animal using the shaft portion 5 or other item described above. Alternatively, the device could be configured to spray or deliver via a conduit or similar, the substance(s) onto the animal's body.

An electrical and/or data connection is provided between the cross member and a data device in the saddle arrangement described below. The apparatus is configured so that the data device sends signals in response to the received measurements to introduce the substance(s) into or onto the animal's body.

In a preferred form, the rods are moveable relative to the saddle arrangement, to provide adjustable rearward extension from the saddle arrangement. In a preferred form, a ratchet mechanism (not shown) could be used to adjust the positions of the rods relative to the saddle arrangement. In an alternative form, a quick-release type mechanism could be used to adjust the positions of the rods relative to the saddle arrangement. Any other adjustable connection type could be used and is encompassed by the scope of the present invention.

In the preferred form, the saddle arrangement 1 additionally or alternatively includes a fluid reservoir. The fluid reservoir may form part of the saddle arrangement or alternatively may be detachable from the saddle arrangement. A fluid transfer tube is in fluid communication with the fluid reservoir and extends through the conduit 8 into the opening 9 in the cross member 4 to transfer fluid from the fluid reservoir to the continuous internal channel of the cross member 4 and shaft portion 5. The fluid is then dispersed through an aperture 9 located in a part of the shaft portion 5 which will be located in the cavity of the animal.

In the preferred embodiment shown, the saddle arrangement includes three reservoirs containing different substances, which are fluidly connected to the shaft portion via three tubes extending through the conduit 8, through the channel in the cross member 4 and the shaft portion 5, and to respective apertures 9 in the shaft portion. Other numbers of reservoirs, tubes and apertures could be provided. An electronic device could be provided in or in combination with the saddle arrangement to determine when the different substances should be delivered to the animal via the shaft portion. The substances will preferably be delivered to the shaft portion via one or more pumps, such as that described in co-pending New Zealand Patent Application No. 523300. The apparatus may be configured such that the shaft portion 5 could be used to take samples from the orifice of the animal by reversing the pump.

In a more simplified form, the fluid reservoir may be attached to or integral with the cross member 4 or shaft portion 5. Such a reservoir could be in the form of a vial, test tube, or the like. The fluid is then transferred directly from the fluid reservoir to the internal channels of the cross member 4 and/or shaft portion 5 for delivery through one or more apertures located in the shaft portion.

The rods are preferably made from an aluminium or plastics material for example. The shaft portion and/or cross member may be made from a plastics material for example.

Figure 3 shows one suitable arrangement for dispensing a substance into the urine stream of an animal, and unless described below the features can be considered to be the same as in Figures 1 and 2. Again the member 103 includes a cross member 104 which is attachable to the resilient rods via clips 106 located at each end of the cross member 104. The member 103 is shown as including a shaft portion 105 for insertion into a natural orifice of the animal, although it should be appreciated that is not essential.

The member has an aperture 111, and a tube 108 extends from a fluid reservoir 113 to a position adjacent the aperture 111. A sensor 115 is positioned adjacent the aperture 111, which in this embodiment is defined by a pair of wires positioned near the aperture 111. In use, the cross member 104 is configured to be located in a position adjacent the animal's body such that urine will pass through the aperture 111 when the animal urinates. The two

wires from the sensor 115 form an open circuit with a controller 117 for a valve 119, which selectively blocks off fluid communication between the fluid reservoir 113 and the end of the tube 108 adjacent the aperture 111.

When an animal urinates, the urine closes the circuit between the two wires of the sensor, which triggers the controller 117 to open the valve 119, thereby allowing fluid to pass from the reservoir 113 through the tube 108. Due to the positioning of the end of the tube adjacent the aperture 111, fluid from the reservoir will be delivered into the urine stream of the animal.

It will be appreciated that modifications can be made to this embodiment. For example, rather than using a valve 119, a pump could be provided which is actuated when the circuit formed by the wires of the sensor 115 is closed as the animal urinates. A similar configuration could be used with the pump configured to operate in reverse, such that as the animal urinates, the pump sucks urine through the tube and delivers the urine to the reservoir to collect samples. Different types of sensors could be used.

Figure 4 shows another suitable arrangement for dispensing a substance into the urine stream of an animal, and unless described below the features can be considered to be the same as in Figures 1 and 2. Again the member 203 includes a cross member 204 which is attachable to the resilient rods via clips 206 located at each end of the cross member 204. The member 203 may or may not include a shaft portion for insertion into a natural orifice of the animal.

The member has a central portion 210 having an aperture 211, and a tube 208 extends from a fluid reservoir (not shown) to a position adjacent within the aperture 211. It can be seen that the aperture has an upper opening followed by tapering wall portions 211a, 211b. Below the tapering wall portions are substantially parallel wall portions 211c, 211d. It will be appreciated that the cross sectional area of the upper opening is greater than the cross sectional area between the wall portions 211c, 211d.

In use, the cross member 204 is configured to be located in a position adjacent the animal's body such that urine will pass through the aperture 211 when the animal urinates. This

configuration avoids the need for sensors, valves or pumps to control the delivery of substance into the animal's urine. Instead, the diameter of the tube 208 is selected depending on the particular substance to be delivered, such that the surface tension of the substance will hold it within the tube.

The aperture 211 forms a venturi mixer, and due to the reduced cross sectional area between the wall portions 211c, 211d, the urine U passing through that region will travel at a greater velocity and lower pressure than in the upper part of the aperture. The urine travelling at greater velocity and reduced pressure will cause the substance in the tube 208 to be sucked out of the tube 208 as indicated by arrow S and mixed with the animal's urine.

Suitable substances for delivery to the urine stream by the embodiments of Figures 3 and 4 include, but are not limited to, selenium which forms a fertilizer for the ground, urease inhibitors, or a reagent such as one or more of the group consisting of phenolphthalein, methyl orange, litmus, bromothymol blue or a universal indicator to measure or indicate pH via a colour change. In the latter example, the member could be provided with means to also collect urine after mixing with the substance, for later analysis.

The above describes preferred forms of the invention and any modifications made thereto without departing from the scope of the invention.

For example, rather than providing the rods with a saddle arrangement, the rods may simply be maintained in position on the animal by a belt, brackets, ties or the like. In such an embodiment, the fluid reservoir and/or data device as applicable could be provided as an integral part of the cross member or shaft portion, or may be provided as separate items.

The preferred embodiment is shown in a particular configuration for use with a cow. It will be appreciated that the device is adaptable for use with other non-human animals including but not limited to sheep, deer, pigs and horses. The preferred embodiment is also shown with the shaft portion arranged for insertion into a vagina. It will be appreciated that the device can be used for inserting or maintaining an item in or near another natural orifice of an animal, such as an anus, mouth or nostril. For example, a rod or rods could be

configured to overhang an animal's head or snout, and hang down to or past the nostrils of the animal, with a shaft portion or item extending into the nostril. Again by providing for vertical movement between the item and rod(s), stress and chaffing will be reduced.

The preferred embodiment is shown as having a pair of resilient rods. That is not essential, however, and the apparatus may be provided with a single resilient rod. Such a rod would still serve to maintain the cross member 4 in contact with the animal's body, and in the embodiment with a shaft portion 5 or other item for insertion into the orifice, maintain the shaft portion or item in the orifice. For example, a single rod could have a rigidly mounted cross member which is held against the animal's body in the region of the animal's vagina to sense when urination occurs. As another example, a device having a substantially T-shaped cross member and shaft portion could be slidably mounted to the rod approximately at the intersection of the shaft portion and cross member, to maintain the shaft portion within the cavity and the cross member against the animal's body. A substantially L-shaped device with a shaft portion and cross member extending from one side of the shaft portion could also be slidably attached to a single rod, preferably in the region of the intersection of the shaft portion and cross member.

For additional stability, the apparatus could be provided with more than two rods.

It will be appreciated that the rods need not be substantially circular in cross section as shown, although that is the preferred embodiment. Rather, the rods could be substantially flat members, could be elliptical, or could be other polygonal cross-sectional shapes for example.

The preferred embodiments shown and described provide a number of advantages.

The preferred embodiments shown and described enable an item to be positioned in or near a natural orifice of a non-human animal, to take readings or deliver or extract substances as required, and in particular when the animal is in the field.

In the embodiment in which the cross member is slidably mounted to a rod(s), and which has a shaft portion or item for insertion into the orifice, the apparatus maintains the shaft

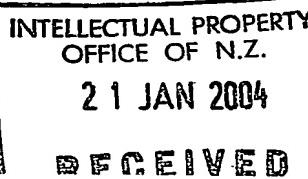
portion or item in the orifice but enables vertical movement of the shaft portion or item relative to the rod(s), which allows the device to move with movement or back straining of the animal. This allows the animal to have a greater degree of comfort and reduces chaffing in the orifice or associated cavity, which minimises the likelihood of infection and enables the device to be maintained in the orifice for a longer period than would otherwise be possible.

The vertical movement of the cross member relative to the rod(s) reduces stress and likelihood of breakage of the apparatus than would be presented by a probe held in a fixed vertical position.

In the embodiment having only the cross member, the resiliency of the rods maintains the cross member in a desired position against the body of the animal .

**CLAIMS**

1. A positioning apparatus for positioning an item in or near a natural orifice of a non-human animal, including: at least one resilient rod adapted to the shape of part of the animal's body above the orifice and to overhang that part of the animal's body; and a transverse cross member mounted on the rod(s) in the overhanging region of the rod(s), which cross member is adapted in use to be biased into contact with the animal's body in the region of the natural orifice as a result of the resilience of the rod(s).
2. An apparatus for positioning an item near a posterior natural orifice of a non-human animal, including: a pair of resilient rods adapted to the shape of the animal's rump and to overhang the animal's rump; and a cross member connected to and extending between the rods in the overhanging region, the cross member including or attached to a sensor for sensing when an animal is urinating or to measure a urine property, the resiliency of the rods being such that in use the cross member and thereby the sensor is positioned adjacent the animal's body in the region of a posterior orifice.
3. An apparatus for positioning an item in a posterior natural orifice of a non-human animal, including: a pair of resilient rods adapted to the shape of the animal's rump and to overhang the animal's rump; and a cross member slidably connected to and extending between the rods in the overhanging region, the cross member being arranged for connection to an item to be inserted into a posterior orifice of the animal, and enabling vertical movement of the cross member relative to the rods in response to movement of the animal.
4. An apparatus for positioning a shaft portion in a posterior natural orifice of a non-human animal, including: a pair of resilient rods adapted to the shape of the animal's rump and to overhang the animal's rump; and a substantially T-shaped member, which includes a transverse cross member which is slidably connected to and extending between the rods in the overhanging region and a shaft portion for insertion into the orifice of the animal, the cross member being vertically moveable relative to the rods in response to movement of the animal.



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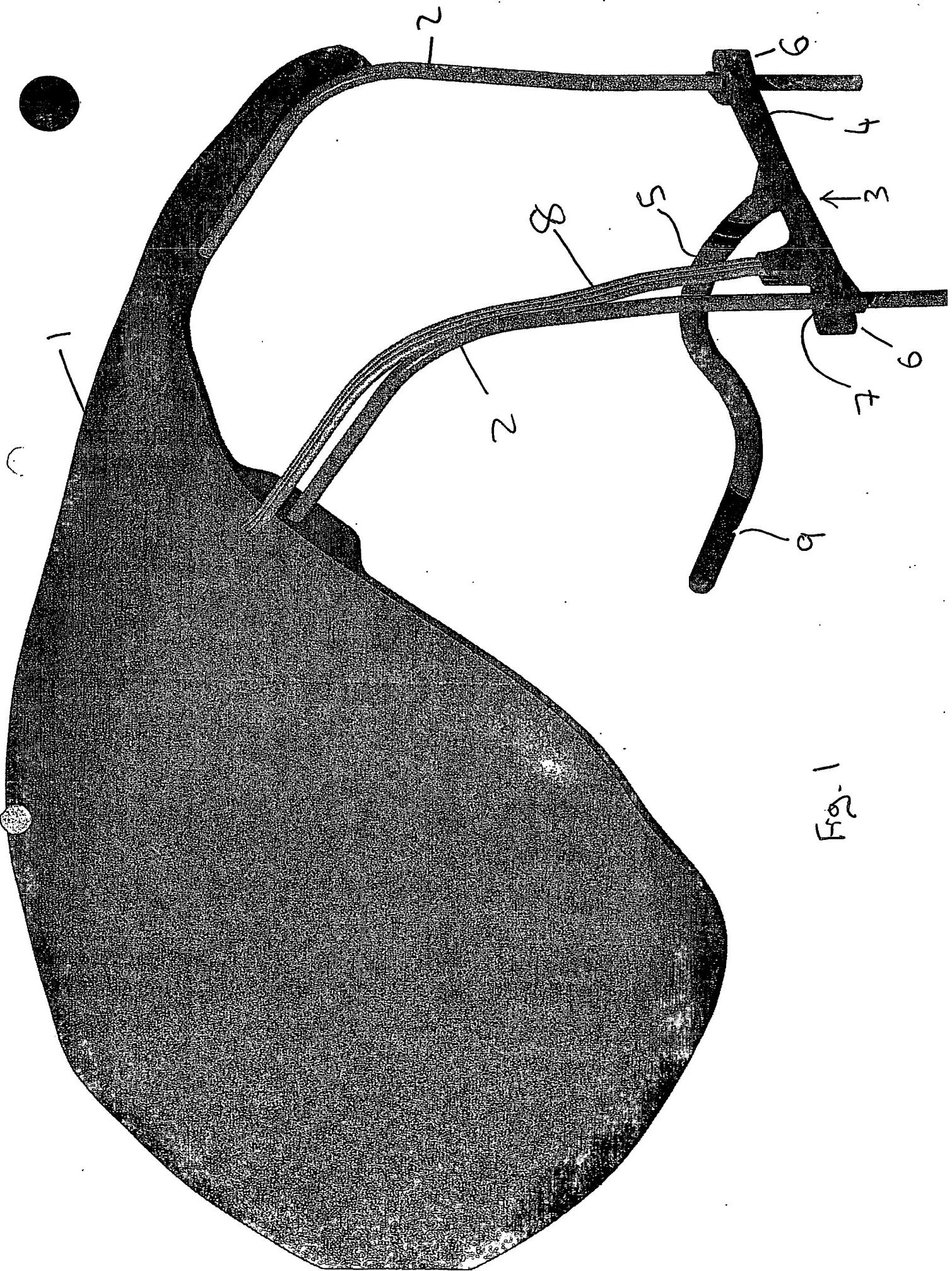


Fig. 1



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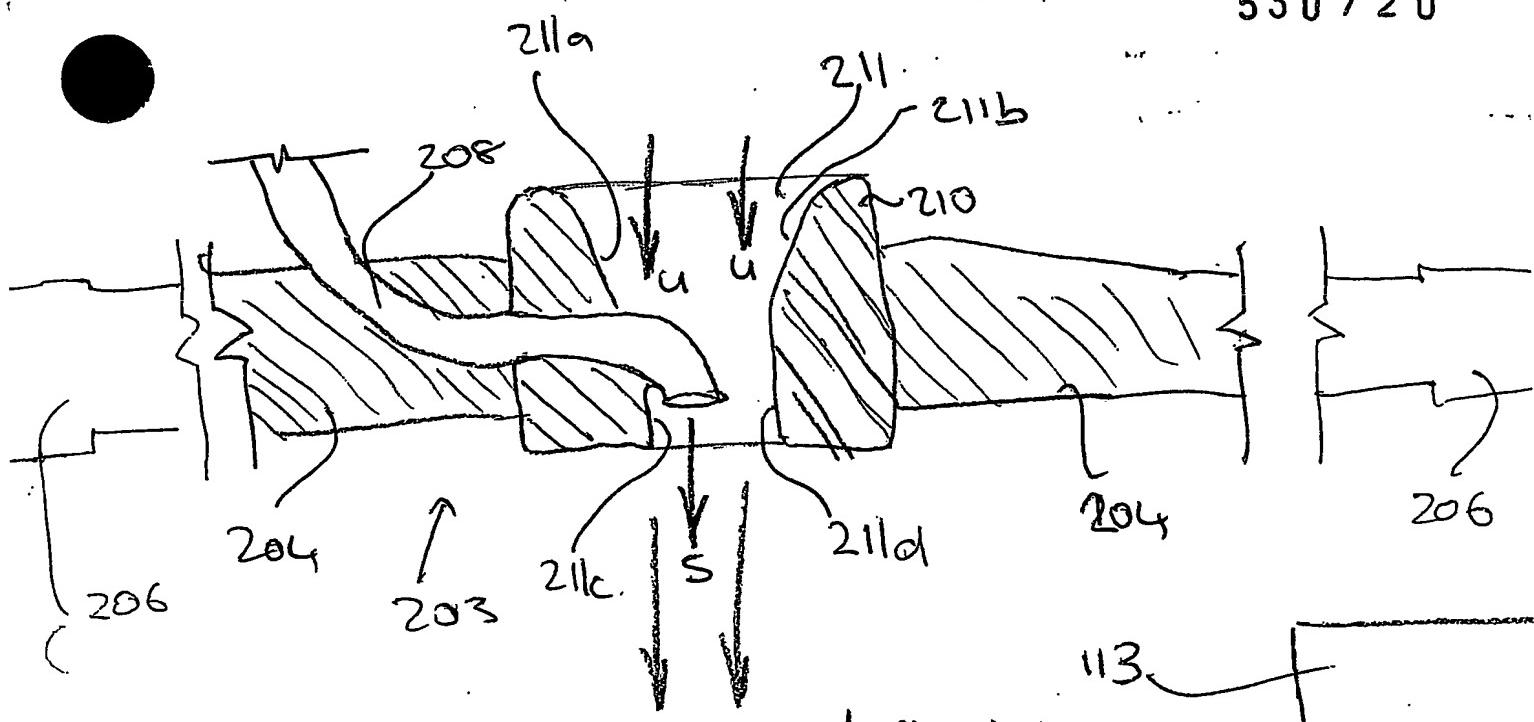


Fig. 4

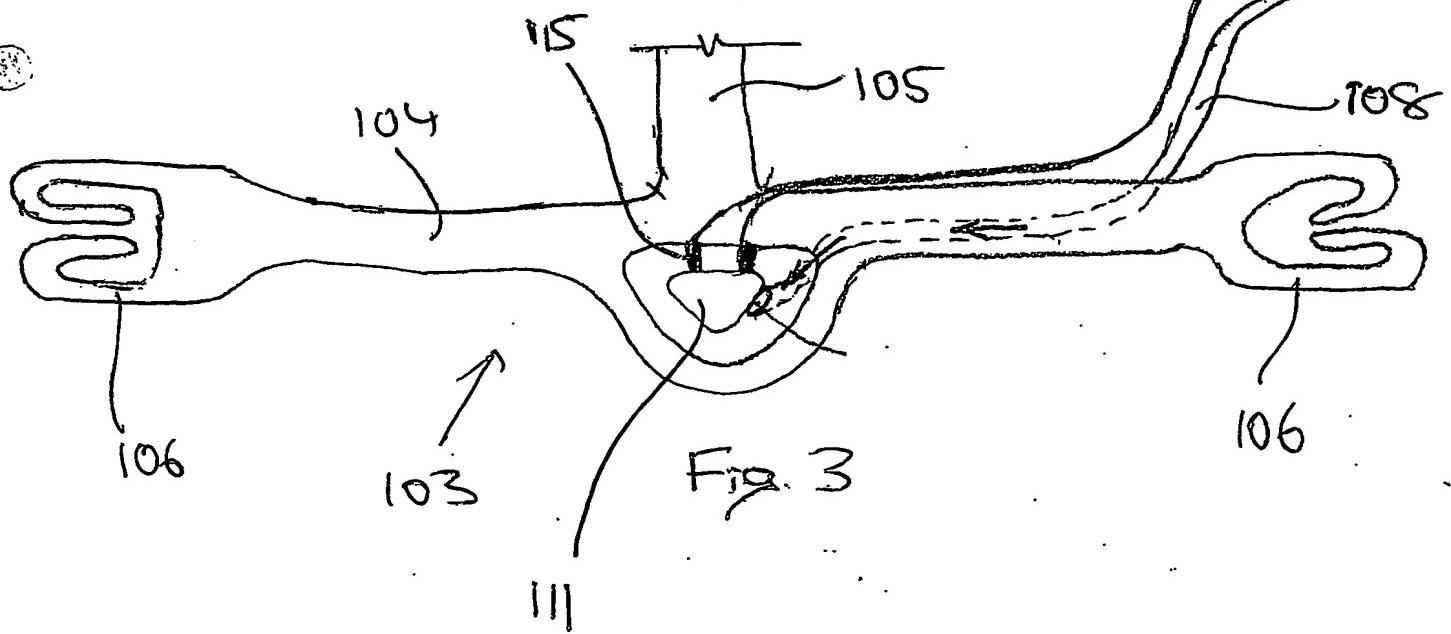


Fig. 3

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